REMARKS

By the present amendment, claims 36 to 36 are pending in the application.

Claim Amendments

Claim 36

Support for the steps of new independent claim 36 may be found as follows.

Step (a): prior dependent claim 21.

Step (b): prior dependent claim 22.

Step (c): prior dependent claim 23.

Step (d): prior independent claim 18.

Step (e): Specification page 6, line 33 to page 7, line 3 and page 15, line 26 to page 16, line 23.

Claims 37 and 38

New dependent claims 37 and 38 are substantially similar to prior dependent claims 34 and 35.

Reconsideration Of Finality

Reconsideration of the finality of the rejection of the Office Action mailed April 17, 2007 is respectfully requested.

The claims of the amendment filed on February 27, 2007 were not amended in response to a rejection over the prior art.

The reference used to reject the claims under 35 U.S.C. §102(a) in the Office Action mailed November 15, 2006 was removed as prior art by a Declaration Under 37 C.F.R. §1.132.

The claims were not amended in the amendment filed on February 27, 2007 in response to rejection. The claims were amended in response to a Claims Objections in the Office Action mailed November 15, 2006.

In view of the foregoing, it is respectfully requested that the finality of the rejection of the Office Action mailed April 17, 2007 be withdrawn.

§102/§103

Claim 35 was rejected under 35 U.S.C. §102(b) as being anticipated by U.S. Pub. 2002/0189726 to Statnikov ("US '726") or U.S. Patent No. 6,467,321 to Prokopenko et al. ("US '321").

Claims 18 to 35 were rejected under 35 U.S.C. §103(a) as being unpatentable over U.S. Patent No. 5,625,664 to Berkley ("US '664") in view of Statnikov ("US '726") or Prokopenko et al. ("US '321").

These rejections, as applied to new claims 36 to 38 of the present amendment, are respectfully traversed.

Present Invention

The present invention provides, as amended, a treatment method for improving fatigue life of a metal material characterized by comprising the steps of; for portions of a metal material for which fatigue may become a problem, (a) detecting a crack for the portions to be subjected to the ultrasonic impact treatment by liquid penetrant examination, magnetic particle examination or eddy current examination; (b) if a crack is detected, removing the crack by a grinder or by gouging; (c) if a removal depth is as deep as 5 mm or greater, repairing the removal portion by buildup welding; (d) then performing

ultrasonic impact treatment; and then (e) confirming that a curved surface having depth of 0.05 mm or greater and a radius curvature of 0.5 mm or larger is formed at the ultrasonic impact treated surface.

One of the technical features of the present invention is that prior to performing an ultrasonic impact treatment, it includes a step of removing a crack when a crack is found in the crack detecting examination and a step of repairing the crack removed portion by buildup welding only when depth of the crack removed portion is 5 mm or greater as shown in Fig. 1 of the drawings of the present application.

When the depth of the crack removed portion is 5 mm or greater, since the cross sectional deficiency and the stress concentration become serious, even if an ultrasonic impact treatment is performed without repairing the portion by buildup welding, the effect of improving fatigue strength cannot be obtained.

Although it is preferable to repair all the portions where the depth of the crack removed portion is very small by buildup welding, a large amount of load, time and cost for the repair work is required.

Therefore, repairing the crack removed portion by buildup welding is specified to the portion where depth of the crack removed portion is 5 mm or greater.

Based on the above explained findings, the present invention provides a practical and an effective method for improving fatigue life of metal materials.

Another technical feature of the present invention is that it includes a specified quality assurance test method.

In order to confirm that compressive residual stress necessary for improving fatigue life is generated at the portion subjected to the ultrasonic impact treatment, the quality

assurance test method of the present invention only requires to confirm that the treated surface has depth of 0.05 mm or greater and a radius curvature of 0.5 mm or more.

This is a very simple and effective method compared with a method disclosed in US '664 to Berkley.

According to the present invention, since the ultrasonic impact treatment is combined with proper pretreatment, i.e., performing crack detecting, crack removing and repairing of specified crack removal portion, and an effective quality assurance test, a remarkable effect can be obtained in that fatigue generated on a metal surface can be reliably suppressed and fatigue life can be improved.

Patentability

U.S. '726 to Stanikov relates to ultrasonic machining and reconfiguration of a braking surface and discloses a method for replacing a defect exhibiting residual tensile stress and tool marks with a smooth compressive braking surface and improve braking strength by using ultrasonic vibration impact.

However, US '726 does not disclose or suggest performing a crack detecting step, a crack removing step, a repairing step of a specified crack removal portion prior to performing the ultrasonic impact treatment, and performing an effective and simple quality assurance test after the ultrasonic impact treatment.

Therefore, US '726 cannot obtain a remarkable effect in that fatigue generated on a metal surface can be reliably suppressed and fatigue life can be improved.

US '321 to Prokopenko relates to a device for ultrasonic peening of metals and discloses an ultrasonic peening machine applicable to the ultrasonic impact treatment of metal materials.

However, US '322 does not disclose or suggest method which effectively improves fatigue life of metal materials.

That is, US '321 does not disclose or suggest performing a crack detecting step, a crack removing step, a repairing step of a specified crack removal portion prior to performing the ultrasonic impact treatment, and performing an effective and simple quality assurance test after the ultrasonic impact treatment.

US '664 to Berkley relates to methods for the design, quality control and management of fatigue-limited metal components and discloses measurement of residual compressive stress in the critical surface of components by a non-destructive method in order to estimate the service life of the components.

However, in this method of US '664, the residual compressive stress is measured by X-ray diffraction techniques which require large inspection equipment.

On the other hand, according to the present invention, generation of residual compressive stress can be confirmed only by confirming that the treated surface has depth of 0.05 mm or greater and a radius curvature of 0.5 mm or more.

This is a very simple and effective method compared with the complex method disclosed in US '664.

US '664 does not disclose or suggest this simple and effective method of the present invention for confirming residual compressive stress.

It is submitted that the present invention is different from that of US '664 and cannot be arrived at if US '664 is combined with US '726 and/or US '321.

It is therefore submitted that new independent claim 36, and claims 37 and 38 dependent thereon, are patentable over U.S. Patent No. 5,625,664 to Berkley in view of U.S. Pub. No. 2002/0189726 to Statnikov or U.S. Patent No. 6,467,321 to Prokopenko et al.

CONCLUSION

It is submitted that in view of the present amendment, and foregoing remarks, the application is now in condition for allowance. It is therefore respectfully requested that the application, as amended, be allowed and passed for issue.

Respectfully submitted,

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